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可重置極化及頻率之微帶天線設計(2/2)

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摘要

本計畫將對於極化及頻率可重置的微帶天線作深入的探討並提出相關的設計技術。首先將在圓形環槽孔耦合微帶天線結構中，利用兩個開關二極體分別重置耦合槽孔形狀及饋入線上開路殘枝的長度，使天線可在垂直及水平極化間切換，且這兩正交線極化可操作在相同頻帶。當在此線極化切換天線中引進一個擾動元素，這兩正交線極化將分別轉換為左旋及右旋圓極化，因而形成圓極化切換天線。若這個擾動元素的導通狀態經由一個二極體控制，則此單一饋入天線將可在相同頻帶下提供四種不同極化。對於上述的四極化切換設計，在先期研究中已證實具有可行性，但仍有幾個問題尚待解決，包括圓極化頻寬太窄、輻射場型不對稱、偏壓電路耦合效應、及背向輻射過大等問題，在計畫第一年將針對這些問題提出解決方式。而在計畫第二年將發展具有正交極化切換之雙頻微帶天線。首先將以第一年所設計完成的垂直/水平極化切換天線為基礎，分別利用改變輻射金屬片的外觀尺寸及埋入細槽孔的方式，使兩正交線極化在切換時操作在不同頻帶。接著探

討可同時切換圓極化極性及頻率的設計方法，計畫利用輻射金屬片上的一對截角作為擾動元素，經由選擇適當的截角尺寸，使天線從左旋圓極化轉換為右旋圓極化，且兩正交圓極化可操作在不同頻帶，因此，若利用兩個二極體控制截角的導通狀態，將可完成具有正交圓極化切換之雙頻天線。此外，對於所提出之極化切換雙頻天線結構，如何調整兩操作頻帶的頻率比也是第二年計畫的研究重點。

關鍵字：槽孔耦合微帶天線；可重置天線；極化變換

Designs of Reconfigurable Microstrip Antennas with Polarization and Frequency Diversities(2/2)

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Abstract

The designs of an aperture-coupled microstrip antenna with switchable polarization and frequency are studied in the two-year project. A single-fed reconfigurable microstrip antenna that can provide various polarization diversities at the same operating frequency will be first investigated. The antenna is excited by a microstrip feed line through aperture coupling. When two PIN diodes are used to respectively reconfigure the coupling slot and the open stub of the feed line, the polarization of the microstrip antenna can be switched between vertical and horizontal polarizations. For the reconfigurable antenna with the linear polarization (LP) diversity, it can be converted to a circularly-polarized (CP) antenna with switchable polarization sense by introducing a perturbation segment. Moreover, an antenna with a quadri-polarization diversity will be developed from the structure of the switchable CP microstrip antenna. Several problems for the proposed polarization reconfigurable antenna will be also addressed. The design methods of a dual-frequency microstrip antenna capable of switching polarization sense between two orthogonal polarizations will be investigated in the second year. Referring the reconfigurable antenna with the LP diversity, studied in the first year, it is expected that the frequency ratio of the operating frequencies of the two LP modes can be varied by changing the aspect ratio of the radiating patch or embedding a thin slot into a square radiating patch. To achieve a switchable CP antenna with frequency agility, a new antenna structure will be proposed. The proposed antenna is fed by a microstrip line through the coupling of an aperture in the ground plane. First, it is found that a CP mode can be excited when the radiating patch is square and an open-ring slot is used as the coupling aperture. Then, by truncating the radiating patch, another CP mode can be obtained. The two CP modes have reversed polarization senses, and their operating frequencies are different. The key parameters which can change the frequency ratios of the two operating frequencies will be also

explored. For the reconfigurable antennas studied in this project, several prototypes integrated with voltage-controlled diodes will be constructed and measured to exhibit their characteristics.

Key words : Aperture-coupled microstrip antenna;

Reconfigurable antenna;Polarization diversity